WHAT IS CLAIMED IS

5

      1. An image forming method, comprising the steps of:

      a) multi-level quantizing a multi-tone image by an error diffusion method; and

10   b) representing each pixel of the thus-quantized image having a quantized level higher than 0 using a dot which is larger as the quantized level thereof is higher,

      wherein occurrence of dots having a specific
15 size is repressed in a specific shade region relating to the dots.

20

      2. The method as claimed in claim 1, wherein occurrence of the smallest dots is repressed.

25

3. The method as claimed in claim 1, wherein occurrence of the dots other than the largest dots is repressed.

5

4. The method as claimed in claim 1, wherein an occurrence rate of the dots having the specific size

10 is controlled based on the number of dots in a specific region in the periphery of a target pixel.

15

5. The method as claimed in claim 1, wherein an occurrence rate of the dots having the specific size is controlled based on the number of dots in a specific region in the periphery of a target pixel and a shade

20 level of the target pixel.

25 6. The method as claimed in claim 1, wherein

an occurrence rate of the dots having the specific size
is controlled based on the number of dots having a
specific size in a specific region in the periphery of a
target pixel.

5

7.   The method as claimed in claim 1, wherein
10   an occurrence rate of the dots having the specific size
is controlled based on the number of dots having a
specific size in a specific region in the periphery of a
target pixel and a shade level of the target pixel.

15

8.   The method as claimed in claim 1, wherein
a degree of repressing occurrence of the dots having the
20   specific size is changed according to a feature of the
image.

25

9. The method as claimed in claim 8, wherein occurrence of the dots having the specific size is repressed only for a picture region of the image.

5

10. The method as claimed in claim 8, wherein the degree of repressing occurrence of the dots having the specific size is made weaker for a character region of the image than for a picture region of the image.

10

15

11. The method as claimed in claim 8, wherein occurrence of the dots having the specific size is repressed only for a non-edge region of the image.

20

12. The method as claimed in claim 1, wherein repressing of occurrence of the dots having the specific size is performed for a medium shade region of the image.

25

13. The method as claimed in claim 1, wherein repressing of occurrence of the dots having the specific size is performed for a dark shade region of the image.

5

14. The method as claimed in claim 1, wherein repressing of occurrence of the dots having the specific

10 size is performed for medium and dark shade regions of the image.

15

15. An image processing method, comprising the steps of:

a) multi-level quantizing multi-tone image data; and

20 b) repressing occurrence of one or more specific quantized levels for a specific level region of the image data relating to the one or more specific quantized levels.

25

16.   The method as claimed in claim 15, wherein re-quantization is performed for the one or more specific quantized levels, occurrence of which is to be repressed.

5

17.   The method as claimed in claim 15,

10 wherein occurrence of the one or more specific quantized levels is repressed for a medium level region of the image data.

15

18.   The method as claimed in claim 15, wherein occurrence of the one or more specific quantized levels is repressed for a high level region of the image

20 data.

25   19.   The method as claimed in claim 15,

wherein occurrence of the one or more specific quantized

levels is repressed for medium and high level regions of

the image data.

5

20. The method as claimed in claim 15,

wherein an occurrence rate of the one or more specific

10   quantized levels, occurrence of which is to be repressed,

is controlled based on the number of pixels quantized to

quantized levels higher than 0 in a specific region in

the periphery of a target pixel.

15

21. The method as claimed in claim 15,

wherein an occurrence rate of the one or more specific

20   quantized levels, occurrence of which is to be repressed,

is controlled based on the number of pixels quantized to

quantized levels higher than 0 in a specific region in

the periphery of a target pixel and the level of the

image data of the target pixel.

25

22. The method as claimed in claim 15, wherein an occurrence rate of the one or more specific quantized levels, occurrence of which is to be repressed, is controlled based on the number of pixels quantized to

5   a specific quantized level in a specific region in the periphery of a target pixel.

10

23. The method as claimed in claim 15, wherein an occurrence rate of the one or more specific quantized levels, occurrence of which is to be repressed, is controlled based on the number of pixels quantized to

15 a specific quantized level in a specific region in the periphery of a target pixel and the level of the image data of the target pixel.

20

24. The method as claimed in claim 15, wherein a degree of repressing occurrence of the one or more specific quantized levels is changed according to a

25 feature of the image.

25. The method as claimed in claim 24, wherein occurrence of the one or more specific quantized levels is repressed only for a picture region of the image.

5

26. The method as claimed in claim 24,

10 wherein the degree of repressing occurrence of the one or more specific quantized levels is made weaker for a character region of the image than for a picture region of the image.

15

27. The method as claimed in claim 24, wherein occurrence of the one or more specific quantized

20 levels is repressed only for a non-edge region of the image.

25

28.   The method as claimed in claim 17,
wherein re-quantization is performed for the one or more
specific quantized levels, occurrence of which is to be
repressed.

5

29.   The method as claimed in claim 18,
10   wherein re-quantization is performed for the one or more
specific quantized levels, occurrence of which is to be
repressed.

15

30.   The method as claimed in claim 19,
wherein re-quantization is performed for the one or more
specific quantized levels, occurrence of which is to be
20   repressed.

25   31.   An image forming method comprising the

steps of:

a) multi-level quantizing multi-tone image data by the image processing method as claimed in claim 15; and

5   b) forming an image from the thus-multi-level-quantized image data using dots for pixels which dots are larger as the pixels have higher quantized levels.

10

32.   An image forming method comprising the steps of:

a) multi-level quantizing multi-tone image data by the image processing method as claimed in claim 15   16; and

b) forming an image from the thus-multi-level-quantized image data using dots for pixels which dots are larger as the pixels have higher quantized levels.

20

33.   An image processing apparatus,

25   comprising:

a first part multi-level quantizing multi-level input image data; and

a second part repressing occurrence of one or more specific quantized levels for a specific level
5   region of the image data relating to the one or more specific quantized levels.

10

34. The apparatus as claimed in claim 33, wherein said second part performs re-quantization for the one or more specific quantized levels, occurrence of which is to be repressed.

15

35. The apparatus as claimed in claim 33,
20 wherein said second part represses occurrence of the one or more specific quantized levels for a medium level region of the image data.

25

36. The apparatus as claimed in claim 33, wherein said second part represses occurrence of the one or more specific quantized levels for a high level region of the image data.

5

37. The apparatus as claimed in claim 33, 10 wherein said second part represses occurrence of the one or more specific quantized levels for medium and high level regions of the image data.

15

38. The apparatus as claimed in claim 33, wherein said second part controls occurrence rates of the one or more specific quantized levels, occurrence of 20 which is to be repressed, based on the number of pixels quantized to quantized levels higher than 0 in a specific region in the periphery of a target pixel.

25

39. The apparatus as claimed in claim 33, wherein said second part controls occurrence rates of the one or more specific quantized levels, occurrence of which is to be repressed, based on the number of pixels

5   quantized to quantized levels higher than 0 in a specific region in the periphery of a target pixel and the level of the image data of the target pixel.

10

40. The apparatus as claimed in claim 33, wherein said second part controls occurrence rates of the one or more specific quantized levels, occurrence of

15   which is to be repressed, based on the number of pixels quantized to a specific quantized level in a specific region in the periphery of a target pixel.

20

41. The apparatus as claimed in claim 33, wherein said second part controls occurrence rates of the one or more specific quantized levels, occurrence of

25   which is to be repressed, based on the number of pixels

quantized to a specific quantized level in a specific region in the periphery of a target pixel and the level of the image data of the target pixel.

5

42.   The apparatus as claimed in claim 33, wherein said second part changes degrees of repressing

10   occurrence of the one or more specific quantized levels according to a feature of the image.

15

43.   The apparatus as claimed in claim 42, wherein said second part represses occurrence of the one or more specific quantized levels only for a picture region of the image.

20

44.   The apparatus as claimed in claim 42,

25   wherein said second part makes the degrees of repressing

occurrence of the one or more specific quantized levels
weaker for a character region of the image than for a
picture region of the image.

5

45.   The apparatus as claimed in claim 42,
wherein said second part represses occurrence of the one
10   or more specific quantized levels only for a non-edge
region of the image.

15

46.   The apparatus as claimed in claim 33,
wherein said second part changes degrees of repressing
occurrence of the one or more specific quantized levels
according to a specified output mode.

20

47.   The apparatus as claimed in claim 35,
25   wherein said second part performs re-quantization for

the one or more specific quantized levels, occurrence of
which is to be repressed.

5

48. The apparatus as claimed in claim 36,
wherein said second part performs re-quantization for
the one or more specific quantized levels, occurrence of
10   which is to be repressed.

15   49. The apparatus as claimed in claim 37,
wherein said second part performs re-quantization for
the one or more specific quantized levels, occurrence of
which is to be repressed.

20

50. The apparatus as claimed in claim 38,
wherein said second part performs re-quantization for
25   the one or more specific quantized levels, occurrence of

which is to be repressed.

51. The apparatus as claimed in claim 39, wherein said second part performs re-quantization for the one or more specific quantized levels, occurrence of which is to be repressed.

52. The apparatus as claimed in claim 40, wherein said second part performs re-quantization for the one or more specific quantized levels, occurrence of which is to be repressed.

53. The apparatus as claimed in claim 41, wherein said second part performs re-quantization for the one or more specific quantized levels, occurrence of which is to be repressed.

54. The apparatus as claimed in claim 42, wherein said second part performs re-quantization for the one or more specific quantized levels, occurrence of which is to be repressed.

5

55. The apparatus as claimed in claim 46,
10 wherein said second part performs re-quantization for the one or more specific quantized levels, occurrence of which is to be repressed.

15

56. An image processing apparatus, comprising:

a first part adding an error to input image
20 data;

a second part multi-level quantizing the image data to which the error is already added by said first part, using a plurality of quantization thresholds;

a third part re-quantizing the quantized data
25 provided by said second part, to another quantized level,

for one or more specific quantized levels other than the highest quantized level and quantized level 0, as the need arises, and outputting the thus-obtained data as an output image data;

5   a fourth part obtaining the error to be added to the input image data, from the output image data and image data to which the error is already added by said first part, and providing the thus-obtained error to said first part; and

10   a fifth part detecting, from the output image data, the number of pixels quantized to be higher than the quantized level 0 in a specific region in the periphery of a target pixel, and providing the thus-obtained number to said third part,

15   wherein said third part compares a threshold, relating to each of said one or more specific quantized levels, determined based on the number provided by said fifth part, with the level of the image data to which the error is already added, and, thereby, determines

20   whether re-quantization for said each of said one or more specific quantized levels is necessary, occurrence of each of said one or more specific quantized levels being repressed in a specific level region of the input image data relating to said each of said one or more

25   specific quantized levels through the re-quantization by

said third part.

5

57. The image processing apparatus as claimed in claim 56, wherein said third part determines that re-quantization is not necessary when the level of the input image data is out of said specific level region

10 relating to each of said one or more specific quantized levels.

15

58. An image processing apparatus, comprising:

a first part adding an error to input image data;

20 a second part multi-level quantizing the image data to which the error is already added by said first part, using a plurality of quantization thresholds;

a third part re-quantizing the quantized data provided by said second part, into another quantized

25 level, for one or more specific quantized levels other

than the highest quantized level and quantized level 0, as the need arises, and outputting the thus-obtained data as output image data;

a fourth part obtaining the error to be added

5   to the input image data, from the output image data and image data to which the error is already added by said first part, and providing the thus-obtained error to said first part; and

a fifth part detecting, from the output image

10   data, the number of pixels quantized to be higher than the quantized level 0 in a specific region in the periphery of a target pixel, and providing the thus-obtained number to said third part,

wherein said third part compares a threshold,

15   relating to each of said one or more specific quantized levels, determined based on the number provided by said fifth part and the level of the input image data, with the level of the image data to which the error is already added, and, thereby, determines whether re-

20   quantization for said each of said one or more specific quantized levels is necessary, occurrence of each of said one or more specific quantized levels being repressed in a specific level region of the input image data relating to said each of said one or more specific

25   quantized levels through the re-quantization by said

third part.

59.　An image processing apparatus,

comprising:

a first part adding an error to input image

data;

a second part multi-level quantizing the image

data to which the error is already added by said first

part, using a plurality of quantization thresholds;

a third part re-quantizing the quantized data

provided by said second part, into another quantized

level, for one or more specific quantized levels other

than the highest quantized level and quantized level 0,

as the need arises, and outputting the thus-obtained

data as an output image data;

a fourth part obtaining the error to be added

to the input image data, from the output image data and

image data to which the error is already added by said

first part, and providing the thus-obtained error to

said first part; and

a fifth part detecting, from the output image

data, the number of pixels for each quantized level in a

specific region in the periphery of a target pixel, and

providing the thus-obtained number to said third part,

wherein said third part compares a threshold,

relating to each of said one or more specific quantized

5   levels, determined based on the total number of pixels

of each of said one or more specific quantized levels

and one or more other quantized levels near to said each

of the one or more specific quantized levels and the

level of the input image data, with the level of the

10   image data to which the error is already added, and,

thereby, determines whether re-quantization for said

each of said one or more specific quantized levels is

necessary, occurrence of each of said one or more

specific quantized levels being repressed in a specific

15   level region of the input image data relating to said

each of said one or more specific quantized levels
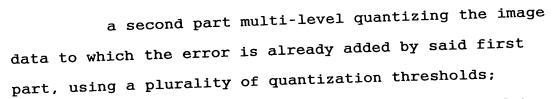
through the re-quantization by said third part.

20

60.   An image processing apparatus,

comprising:

a first part adding an error to input image

25   data;

a second part multi-level quantizing the image data to which the error is already added by said first part, using a plurality of quantization thresholds;

a third part re-quantizing the quantized data

5   provided by said second part, into another quantized level, for one or more specific quantized levels, as the need arises, and outputting the thus-obtained data as output image data;

a fourth part obtaining the error to be added

10 to the input image data, from the output image data and image data to which the error is already added by said first part, and providing the thus-obtained error to said first part; and

a fifth part detecting, from the output image

15 data, the number of pixels quantized to be higher than the quantized level 0 in a specific region in the periphery of a target pixel, and providing the thus-obtained number to said third part,

wherein said third part has a signal

20 indicating a feature of an image region to which the target pixel belongs input thereto from the outside, and compares a threshold, relating to each of said one or more specific quantized levels, determined based on a parameter relating to said each of said one or more

25 specific quantized levels determined according to the

feature indicated by said signal, the number provided by said fifth part and the level of the input image data, with the level of the image data to which the error is already added, and, thereby, determines whether re-

5 quantization for said each of said one or more specific quantized levels is necessary, occurrence of each of said one or more specific quantized levels being repressed in a degree according to said feature in a specific level region of the input image data relating

10 to said each of said one or more specific quantized levels through the re-quantization by said third part.

15

61. The image processing apparatus as claimed in claim 60, wherein:

said signal indicates whether the image region to which the target pixel belongs is a character region

20 or a picture region; and

said parameter relating to each of said one or more specific quantized levels is determined such that occurrence of said each of said one or more specific quantized levels is repressed only for the picture

25 region.

62. The image processing apparatus as claimed in claim 60, wherein:

said signal indicates whether the image region to which the target pixel belongs is a character region

5 or a picture region; and

said parameter relating to each of the one or more specific quantized levels is determined such that the degree of repressing occurrence of said each of said one or more specific quantized levels is made weaker for

10 the character region than for the picture region.

15 63. The image processing apparatus as claimed in claim 60, wherein:

said signal indicates whether the image region to which the target pixel belongs is an edge region or a non-edge region; and

20 said parameter relating to each of the one or more specific quantized levels is determined such that occurrence of said each of said one or more specific quantized levels is repressed only for the non-edge region

25

64. An image processing apparatus,
comprising:

a first part adding an error to input image
data;

5 a second part multi-level quantizing the image
data to which the error is already added by said first
part, using a plurality of quantization thresholds;

a third part re-quantizing the quantized data
provided by said second part, into another quantized
10 level, for one or more specific quantized levels, as the
need arises, and outputting the thus-obtained data as an
output image data;

a fourth part obtaining the error to be added
to the input image data, from the output image data and
15 image data to which the error is already added by said
first part, and providing the thus-obtained error to
said first part; and

a fifth part detecting, from the output image
data, the number of pixels quantized to be higher than
20 the quantized level 0 in a specific region in the
periphery of a target pixel, and providing the thus-
obtained number to said third part,

wherein said third part has a signal
indicating an output mode input thereto from the outside,
25 and compares a threshold, relating to each of said one

or more specific quantized levels, determined based on a

parameter relating to said each of said one or more

specific quantized levels determined according to the

output mode indicated by said signal, the number

5 provided by said fifth part and the level of the input

image data, with the level of the image data to which

the error is already added, and, thereby, determines

whether re-quantization for said each of said one or

more specific quantized levels is necessary, occurrence

10 of each of said one or more specific quantized levels

being repressed in a degree according to said output

mode in a specific level region of the input image data

relating to said each of said one or more specific

quantized levels through the re-quantization by said

15 third part.

65. The image processing apparatus as claimed

20 in claim 56, wherein:

said second part performs 4-level

quantization;

the re-quantization performed by said third

part is performed for the quantized level 1; and

25 occurrence of the quantized level 1 is

repressed in a medium level region of the input image

data.

5

66. The image processing apparatus as claimed

in claim 58, wherein:

said second part performs 4-level

10   quantization;

the re-quantization performed by said third

part is performed for the quantized level 1; and

occurrence of the quantized level 1 is

repressed in a medium level region of the input image

15   data.

67. The image processing apparatus as claimed

20   in claim 59, wherein:

said second part performs 4-level

quantization;

the re-quantization performed by said third

part is performed for the quantized level 1; and

25   occurrence of the quantized level 1 is

repressed in a medium level region of the input image

data.

5

68.   The image processing apparatus as claimed

in claim 60, wherein:

said second part performs 4-level

10   quantization;

the re-quantization performed by said third

part is performed for the quantized level 1; and

occurrence of the quantized level 1 is

repressed in a medium level region of the input image

15   data.

69.   The image processing apparatus as claimed

20   in claim 64, wherein:

said second part performs 4-level

quantization;

the re-quantization performed by said third

part is performed for the quantized level 1; and

25   occurrence of the quantized level 1 is

repressed in a medium level region of the input image

data.

5

70. The image processing apparatus as claimed

in claim 56, wherein:

said second part performs 4-level

10 quantization;

the re-quantization performed by said third

part is performed for the quantized level 1 and

quantized level 2;

occurrence of the quantized level 1 is

15 repressed in a medium level region of the input image

data; and

occurrence of the quantized level 2 is

repressed in a high level region of the input image data.

20

71. The image processing apparatus as claimed

in claim 58, wherein:

25 said second part performs 4-level

quantization;

the re-quantization performed by said third part is performed for the quantized level 1 and quantized level 2;

5   occurrence of the quantized level 1 is repressed in a medium level region of the input image data; and

occurrence of the quantized level 2 is repressed in a high level region of the input image data.

10

72.   The image processing apparatus as claimed

15   in claim 59, wherein:

said second part performs 4-level quantization;

the re-quantization performed by said third part is performed for the quantized level 1 and

20   quantized level 2;

occurrence of the quantized level 1 is repressed in a medium level region of the input image data; and

occurrence of the quantized level 2 is

25   repressed in a high level region of the input image data.

73. The image processing apparatus as claimed in claim 60, wherein:

said second part performs 4-level quantization;

5   the re-quantization performed by said third part is performed for the quantized level 1 and quantized level 2;

occurrence of the quantized level 1 is repressed in a medium level region of the input image 10   data; and

occurrence of the quantized level 2 is repressed in a high level region of the input image data.

15

74. The image processing apparatus as claimed in claim 64, wherein:

said second part performs 4-level

20   quantization;

the re-quantization performed by said third part is performed for the quantized level 1 and quantized level 2;

occurrence of the quantized level 1 is

25   repressed in a medium level region of the input image

data; and

occurrence of the quantized level 2 is

repressed in a high level region of the input image data.

5

75. The image processing apparatus as claimed in claim 60, further comprising a sixth part generating

10 said signal input to said third part.

15 76. The image processing apparatus as claimed in claim 56, further comprising a sixth part which forms an image from the image output data, using dots for pixels which dots are larger as the pixels have higher quantized levels.

20

77. The image processing apparatus as claimed

25 in claim 58, further comprising a sixth part which forms

an image, from the image output data, using dots for pixels which dots are larger as the pixels have higher quantized levels.

5

78. The image processing apparatus as claimed in claim 59, further comprising a sixth part which forms

10 an image, from the image output data, using dots for pixels which dots are larger as the pixels have higher quantized levels.

15

79. The image processing apparatus as claimed in claim 60, further comprising a sixth part which forms an image, from the image output data, using dots for

20 pixels which dots are larger as the pixels have higher quantized levels.

25

80. The image processing apparatus as claimed in claim 64, further comprising a sixth part which forms an image, from the image output data, using dots for pixels which dots are larger as the pixels have higher

5 quantized levels.

10   81. The image processing apparatus as claimed in claim 56, further comprising a sixth part generating the input image data by optically scanning an original.

15

            82. The image processing apparatus as claimed in claim 58, further comprising a sixth part generating the input image data by optically scanning an original.

20

            83. The image processing apparatus as claimed

25   in claim 59, further comprising a sixth part generating

the input image data by optically scanning an original.

5

84. The image processing apparatus as claimed
in claim 60, further comprising a sixth part generating
the input image data by optically scanning an original.

10

85. The image processing apparatus as claimed
in claim 64, further comprising a sixth part generating
15 the input image data by optically scanning an original.

86. The image processing apparatus as claimed
20 in claim 56, further comprising:
a sixth part generating the input image data
by optically scanning an original; and
a seventh part forming an image, from the
image output data, using dots for pixels which dots are
25 larger as the pixels have higher quantized levels.

87. The image processing apparatus as claimed in claim 58, further comprising:

a sixth part generating the input image data by optically scanning an original; and

5   a seventh part forming an image, from the image output data, using dots for pixels which dots are larger as the pixels have higher quantized levels.

10

88. The image processing apparatus as claimed in claim 59, further comprising:

a sixth part generating the input image data

15 by optically scanning an original; and

a seventh part forming an image, from the image output data, using dots for pixels which dots are larger as the pixels have higher quantized levels.

20

89. The image processing apparatus as claimed in claim 60, further comprising:

25   a sixth part generating the input image data

by optically scanning an original; and

a seventh part forming an image, from the image output data, using dots for pixels which dots are larger as the pixels have higher quantized levels.

5

90. The image processing apparatus as claimed

10 in claim 64, further comprising:

a sixth part generating the input image data by optically scanning an original; and

a seventh part forming an image, from the image output data, using dots for pixels which dots are

15 larger as the pixels have higher quantized levels.

20 91. A computer-readable recording medium storing therein a program for causing a computer to carry out the function of each part of the image processing apparatus as claimed in claim 56.

25

92. A computer-readable recording medium storing therein a program for causing a computer to carry out the function of each part of the image processing apparatus as claimed in claim 58.

5

93. A computer-readable recording medium

10 storing therein a program for causing a computer to carry out the function of each part of the image processing apparatus as claimed in claim 59.

15

94. A computer-readable recording medium storing therein a program for causing a computer to carry out the function of each part of the image

20 processing apparatus as claimed in claim 60.

25 95. A computer-readable recording medium

storing therein a program for causing a computer to
carry out the function of each part of the image
processing apparatus as claimed in claim 64.